

**Measure:** Expanded Residential Energy Efficiency (G14, G14a, G14b)

Design and implement an aggressive residential energy efficiency promotion campaign, using actual savings and co-benefit experiences to emerge from the new ARRA and TEP home efficiency upgrade initiatives.

These programs are consistently showing the potential for up to 3,500 kWh/year in energy savings per participating residence. With the large universe of Tucson homes built prior to the development of energy codes (early 1980s), there is a significant potential to achieve energy, cost and emissions reductions from even small expenditures toward home energy efficiency.

Emission reduction potential by 2020:	47,143 tCO <sub>2</sub> e
Percentage of goal (2012):	0.3%
Percentage of goal (2020):	2.0%
Total annual average implementation costs:	\$1.345 million
Entity that bears the costs of implementation:	Homeowners (\$1.32 million) and City of Tucson (\$25,000/yr)
Cost/Savings per tCO <sub>2</sub> e:	\$61 savings
Net annual savings over 9 year program:	\$1.6 million/yr
Entity that realizes the financial return:	Homeowners (energy savings), City of Tucson (through sales tax revenue), energy efficiency supplies and service sector
Equitability (progressive/regressive, income/revenue neutral, etc):	Likely to be progressive by saving of utility bills for lower income homeowners.
Potential unintended consequences:	Poor quality workmanship that leads to possible indoor air quality issues or lower than projected energy savings.

## **Background information:**

Residential energy use in the City of Tucson represents the City's second largest greenhouse gas emissions source.<sup>1</sup> Although the most cost-effective method for reducing energy use in the housing sector over time is to achieve energy efficiencies in new homes, another method is to improve the energy efficiency of existing homes. This is achieved in some cases with initial energy audits followed by installation of least-first-cost efficiency improvement measures.

Other approaches use specific energy savings targets to drive retrofit program activities or have specific cost-per-house values set for efficiency improvements. An inventory of over 100,000 single-family, owner-occupied homes exist in the City of Tucson, many of them constructed before the advent of even minimum building energy codes.

Approximately 15,300 homes will receive energy efficiency upgrades through existing programs through 2020 and these programs are outlined below. In addition, some homeowners have taken advantage of Federal and State energy efficiency tax credits the past two years. However, these tax credits have now been significantly diminished, leaving a significant pool of homes in Tucson whose owners would benefit from even minimum energy efficiency upgrades.

Recently, the City of Tucson has embarked on a home energy efficiency retrofit initiative funded under the American Recovery and Reinvestment Act. A contractor to the City is engaged in retrofitting 300 single-family homes. The amount of energy to be saved from the retrofit of these 300 homes has been estimated at 3,500 kWh/year/home.<sup>2</sup> First year savings would total 1,050,000 kWh.

Over the ten year and likely longer life of the measures installed (low-flow shower fixtures, solar shades, duct seals, weather-stripping, etc.) this would total a minimum of 10,500,000 kWh saved. Cost of materials and labor for the 300-home project totals \$240,000, not including contractor overhead.

The Tucson Electric Power company is managing a second energy efficiency retrofit initiative in the City. Its TEP Existing Home Program (expected to have a new brand sometime early in 2011) involves a longer-term (than the City's ARRA initiative) program to meet required energy efficiency goals established by the Arizona Corporation Commission.

TEP is required to meet 22% of its 2020 demand (projected without the efficiency initiative) via energy efficiency, and has thus set out on an aggressive program that includes residential energy retrofits. While the program is still taking shape, this much is known.

In 2011, the utility's contractor is charged with conducting 1,000 home energy audits that are expected to result in the installation of 2,600 energy efficiency measures and have a collective savings of 2,052,850 kWh/year. This is a much more extensive

program than that being undertaken by the City with ARRA funds, due to the ACC mandate and the efficiency target sought.

As the program ramps up through 2020, a higher and higher amount of annual (and cumulative) savings is expected from the anticipated 15,000 homes to be audited and upgraded over the decade (2011 – 2020).

Energy efficiency programs such as TEP's in Arizona are funded through a systems benefits charge collected on all customer electricity bills in a given utility service area. Elsewhere in Arizona, Arizona Public Service plans to continue to expand already successful energy efficiency programs to reduce use by 3,100 GWh by 2025.<sup>3</sup>

Finally, the Tucson Urban League (TUL) has received ARRA funding for a major increase in its home Weatherization Assistance Program (WAP) in the City, and will be spending up to \$6,500 on energy efficiency upgrades to qualifying homes in its program.

Statewide, the ARRA-funded low-income weatherization program has completed 3,092 home retrofits as of January 5, 2011 resulting in homeowner savings of over \$902,000 and an energy savings of 7,989,135 kWh. On average, this program has saved almost \$300 per home in the program's first year with a related energy savings of 2,584 kWh/home.<sup>4</sup> The Arizona Commerce Authority maintains a website with streaming dollar and kWh savings from its statewide weatherization assistance program since its inception in September 2009.<sup>5</sup>

The above program highlights are provided as background to illustrate what is already underway in Tucson and the region and demonstrates the potential that several parties recognize for significant cost, energy, and emissions reductions as a result of existing home energy efficiency retrofits.

### **Business-as-Usual:**

Business-as-usual results in the achievement of energy efficiency upgrades on over 15,000 existing homes in Tucson through 2020. While substantial, this represents only 15% of the existing single-family, owner-occupied homes in the City and only about 8% of the single-family residences total (including rentals and vacant homes). Additional potential for energy efficiency retrofits and associated cost savings is clearly available.

### **Description of Measure and Implementation Scenario:**

COT should partner with TEP and TUL to promote the achieved energy and cost savings from programs now underway as a first step in encouraging other homeowners not yet participating in these programs to make EE investments.

On the basis of energy and cost savings emerging from the initial year or two of the TEP and ARRA programs, an effective and aggressive marketing campaign should be developed highlighting the economic return to homeowners and community at large (via the economic multiplier that accompanies consumer-retained utility expenditures) as well as the myriad of co-benefits that accompany residential energy efficiency gains.

The value of an aggressive outreach campaign cannot be underestimated, as most consumers do not have access to straightforward and reliable information about their home's energy use. Without this information, homeowners are less likely to invest in home energy upgrades. This is an area where City leadership and collaboration among those currently implementing energy efficiency projects can have significant payback.

The campaign should set a target of an additional 15,000 residences investing from \$400 to \$1,200 in energy efficiency improvements in their homes. The City might even sponsor a challenge program to identify and highlight through a recognition program those homeowners able to achieve the quickest and most cost-effective energy savings per dollar invested.

The City should also continue to monitor possible future use of a Property Assessed Clean Energy (PACE) mechanism to help assist homeowners with the up-front costs of these efficiency investments. Currently, this opportunity that was being implemented in around 400 cities and counties in 17 states is not currently available pending legal review of lien structuring and related securities issues.<sup>6</sup>

An additional implementation strategy would be to establish by ordinance a requirement that a certain level of quick-payback energy efficiency investments be required as a permit condition for residential renovations above a certain square footage or dollar amount.

Without going into the design of such a program, it could be based on existing and forecasted levels of residential renovations (room-add, new roof, code upgrades, etc.) and combined with the challenge campaign and ultimately a resurrected PACE program should that again become available in the next year or two. The goal would remain the same – 15,000 residences investing in energy efficiency retrofits above the numbers expected to be covered in the existing TEP and ARRA programs.

Note: This measure should be directed to homes which have not previously had energy efficiency upgrades nor which have been constructed since the advent of modern energy efficiency building codes in Tucson. This would include all homes built going forward through the remainder of the decade.

### **Energy/Emission analysis:**

Using the actual and forecasted energy savings from home retrofit programs described above, an additional 15,000 homes investing in energy efficiency retrofits produce

52,500,000 kWh (15,000 x 3,500 kWh/unit) in energy savings at full program implementation (2020).

We project that 11% of the 15,000 homes are added as program participants each of the 9 years to 2020 beginning in 2012. Thus, 1,650 participating homes each year would result in energy savings of 5,775,000 kWh for the new retrofits in that year.

We project the average life of the energy efficiency improvements to be 20 years.

Greenhouse gas savings resulting from a program of this scale would be 5,238 tCO<sub>2</sub>e in 2012, and 47,143 tCO<sub>2</sub>e/year at full program implementation in 2020. The accumulated savings by 2020 is projected at 235,714 tCO<sub>2</sub>e.

### **Climate Change Impact Summary in tCO<sub>2</sub>e:**

COT 1990 Citywide GHG emissions (baseline):	5,461,020
MCPA 7% reduction target for COT:	5,078,749
2012 BAU GHG emissions projection:	7,000,000
2020 BAU GHG emissions projection:	7,343,141
GHG emissions reduction to meet 7% goal (2012):	1,921,251
GHG emissions reduction to meet 7% goal (2020):	2,264,392
Contribution of this Measure in 2020:	47,143

### **Economic analysis:**

Average program cost to homeowners would be \$800 x 15,000 participating households, or \$12,000,000.

Presumably, the entirety of these costs would be spent in the City of Tucson and thus represent taxable income to the retailers of energy efficiency material and services. The sales tax on \$8,000,000 of energy efficiency materials (assuming 2/3 of program investments are in sales taxable investments rather than services), at the current Tucson sales tax rate of 2.5%, totals \$212,000 over the 9-year program period.

It is impossible to predict whether these taxes would be additional revenues to the City or not – it depends on whether homeowners reduced other taxable expenses. Therefore, this potential economic benefit to the City is not counted in this analysis.

The expense of the City of Tucson's participation in a collaborative energy efficiency campaign would need to be covered by an estimated 0.5 FTE/year for the nine years of the implementation period analyzed (2012 – 2020), for a total cost of \$445,000.

A small surcharge similar to the current system benefits charge on electric bills could spread implementation costs to the entire rate base. This approach makes sense because the electricity savings achieved in a broad energy efficiency retrofit program will delay the need for new powerplants, helping to keep electric rates low.

Homeowner savings will be about \$462,000 in the first year at \$0.08/kWh residential electrical rates. As electric rates increase (we have projected 2.4% per year) the savings increase as well. By 2015 the program will be responsible for savings to Tucson residents of \$6.7 million; by 2020 the program will have saved a total of \$26.9 million.

#### Net Economic Impact

Program costs: \$12,000,000 investment by homeowners plus \$445,000 administration  
Benefits: \$26.9 million saved by 2020; total program savings \$116.8 million through 2040.

Net savings through 2020: \$26.9 million less \$12.45 million = \$14.45 million.

The savings per tCO<sub>2</sub>e saved through 2020 are: 14,450,000 divided by 235,714 = \$61.

Using a 1.5 multiplier, the positive economic impacts of the energy savings would be \$21.68 million.

#### **Co-benefits:**

There are multiple co-benefits that accompany the immediate energy and cost savings that flow from energy efficiency retrofits to currently energy-inefficient residential homes in Tucson. These co-benefits include:

1. An increase in home comfort as cooling and heating systems deliver more of their intended benefits to the conditioned space
2. Likely delay in utility need to build new power plants thus minimizing rate increases owing to new capacity additions
3. Increased adaptive capacity to temperature extremes expected as long-term climate warms in the southwest
4. An increase in property resale values as energy efficiency gets built into a home

## **Equitability:**

No real equitability issues are raised with a voluntary outreach program. Even the lower cost end of efficiency upgrades now taking place are expected to deliver quick payback, so efficiency improvements made are not limited to those at higher income levels.

## **Potential unintended consequences:**

Certain weatherization measures will have the intended effect of making homes tighter to the outside air. Thus, care must be taken that qualified and trained personnel are used to both conduct residential energy audits and perform efficiency upgrades. Efficiency technology installers must be able to identify and exclude from home retrofit programs those homes with attributes not conducive to certain efficiency measures by creating indoor air quality problems (mold, asbestos, etc.).

Similarly, proper bonding and security concerns must be addressed by any potential efficiency program workforce to the degree acceptable to the funding entity or otherwise required by law. Both of these concerns have been customarily addressed in responsible residential retrofit programs.

## **Endnotes**

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<sup>1</sup> Regional Greenhouse Gas Inventory. Pima Association of Governments. October 2008.

<sup>2</sup> Personal Communication with Vanessa Richter, Conservation Services Group. January 2011.

<sup>3</sup> American Council for an Energy Efficient Economy. 2010.  
<http://www.aceee.org/sector/state-policy/arizona>

<sup>4</sup> Arizona Commerce Authority. Low-Income Weatherization Assistance Program, January 2011, at: <http://www.azcommerce.com/Energy/Low-Income+Weatherization+Assistance+Program.htm>.

<sup>5</sup> Arizona Commerce Authority. 2011, at: <http://www.azcommerce.com/Energy/Low-Income+Weatherization+Assistance+Program.htm>.

<sup>6</sup> "Fannie Mae and Freddie Mac Deliver Blow to Popular Solar Energy Program." *Green American*, September/October 2010.